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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] this invention relates to the different direction electroconductive glue for connecting a circuit pattern mutually electrically while pasting up mutually the wiring substrate by which the circuit pattern was formed in the substrate front face.

[0002]

[Background of the Invention] While making it flow through the circuit pattern which confronts each other in the wiring substrates by which the circuit pattern was formed in the substrate front face after the circuit pattern has met, the adhesives (connection sheet) of the sheet fabricated for example, by thermofusion nature as adhesives on which both substrates are pasted up from the adhesives constituent with which the conductive particle was distributed in the reaction hardenability resin like the adhesive component of electric insulation or an epoxy resin are known (refer to JP,62-206772,A, JP,62-40183,A and JP,62-40184,A, JP,5-21094,A, and JP,60-140790,A).

[0003] If heating pressurization of this connection sheet is carried out in the state where it inserted between two wiring substrates, in an insulating adhesive property component, it shifted to the longitudinal direction of the overlapping circuit patterns, and only a conductive particle will be pinched by the circuit pattern, and while being able to carry out through the conductive particle which had the electrical installation of this portion pinched, two wiring substrates can be pasted up by the insulating adhesive property component which forms a connection sheet.

[0004] Many thermoplastic adhesives were used as an insulating adhesive property component in the different direction electroconductive glue by which the above particles are distributed. By using such a thermoplastic adhesive, there is an advantage that it can paste up by carrying out short-time heating pressurization at low temperature comparatively.

[0005] However, the different direction conductivity adhesion which used such a thermoplastic adhesive has the field which cannot be referred to as that the thermoplastic adhesive which is an insulating adhesive property component has sufficient with-time stability. That is, when an adhesive component uses by the severe condition using the wiring substrate pasted up using the different direction electroconductive glue which is a thermoplastic adhesive by the high-humidity/temperature condition for a long period of time etc., an adhesive component plasticizes and it may come to have a flow. And the conductive particle held between circuit patterns may move with a flow of an adhesion component, and the conductivity between circuit patterns, i.e., an electric resistance value, becomes unstable.

[0006] In order to solve such a problem, using thermosetting resin like an epoxy resin as an insulating adhesive property component is also proposed. If thermosetting resin is used as an adhesive component, although the above moisture-proof thermal stability and reliability can improve sharply, generally a working life is short, and sticking-by-pressure conditions are elevated temperatures, and such thermosetting resin has the problem of becoming a long time. For example, when using the thermosetting adhesive of an epoxy system, if it is common to have heated for 20 to 30 seconds and to have pasted up, putting the pressure of 40 - 50 kg/cm² on 170-180-degree C heating conditions and heating temperature and heating time are short, hardening will be inadequate and sufficient bond strength and flow reliability will not be acquired.

[0007] In recent years, in the field of the precision electronic equipment for which different direction conductivity adhesion is needed, the densification of a circuit is achieved and the circuit pattern which carries out different direction conductivity adhesion is becoming narrowly and thin. In case it is made to join and flow through the circuit pattern formed in the substrate which consists of a transparent metal thin film (ITO= indium oxide) of a liquid crystal device especially, and TCP (tape carrier package) which carried the driver IC, when an adjoining electrode spacing pastes up on the different direction conductivity adhesion conditions of the former [wiring / sake / narrow] very narrowly, it exfoliates and also defluxion and that the substrate itself receives an injury have wiring. On the other hand, since an adhesives component softens with change of the service temperature of liquid crystal even if an adhesive component carries out different direction conductivity adhesion of the circuit pattern of such liquid crystal using the different direction electroconductive glue which is a thermoplastic adhesive, there is a problem that the electrical property between substrates falls by movement of the conductive particle in adhesives, gap of a substrate, etc.

[0008]

[Objects of the Invention] This inventions are low temperature and low voltage, and aim at offering the different direction electroconductive glue which can be pasted up for a short time.

[0009] Furthermore, they aim at offering the different direction electroconductive glue which can secure this bond strength

and conductivity for a long period of time while this inventions are low temperature and low voltage, and can be hardened by short-time adhesion and can make good conductivity discover between a good bond strength and the circuit pattern of a different substrate.

[0010]

[Summary of the Invention] The different direction electroconductive glue of this invention is a different direction electroconductive glue which consists of a metal content particle distributed in the adhesives component which has insulation, and this adhesives component. this adhesives component An acrylic adhesive property component, (Meta) By containing the reactant component which has at least two acryloyl machines, and a polymerization initiator this adhesives component hardens by heating or optical irradiation, and is characterized by joining the substrate which is an adherend in different direction electric conduction (that is, it arranging so that the circuit pattern formed in the two substrates front face may be confronted each other, and conductivity being secured between this circuit pattern that confronts each other -- as -- adhesion)

[0011] As for the different direction electroconductive glue of this invention, the metal content particle is distributed in the adhesives component which contains an acrylic adhesive property component, the reactant component which has two or more acryloyl (meta) machines, and a polymerization initiator as mentioned above, and this adhesive component can paste up two substrates which confront each other in different direction electric conduction by heating or optical irradiation while showing insulation.

[0012] And by the adhesives component which was blended with the different direction electroconductive glue of this invention unlike the conventional thermoplastic acrylic adhesives blending the reactant component and polymerization initiator which have two or more acryloyl (meta) machines although it has the fluidity proper as adhesives before heating or optical irradiation, and performing heating operation or optical irradiation in these adhesives, these acrylic adhesives are hardened and the fluidity disappears.

[0013]

[Detailed Description of the Invention] Hereafter, the different direction electroconductive glue of this invention is explained concretely. The different direction electroconductive glue of this invention consists of a metal content particle distributed in the adhesives component which has insulation, and this adhesives component.

[0014] This adhesives component contains the reactant component which has an acrylic adhesive property component and at least two acryloyl (meta) machines, and the polymerization initiator. An acrylic adhesive property component is usually the copolymer of alkyl (meta) acrylate, a functional-group content monomer, and other monomers here.

[0015] As an example of the alkyl (meta) acrylate used in this invention Methyl (meta) acrylate, ethyl (meta) acrylate, isopropyl (meta) acrylate, n-butyl (meta) acrylate, isobutyl (meta) acrylate, 2-ethylhexyl (meta) acrylate, iso octyl (meta) acrylate, Lauryl (meta) acrylate, stearyl (meta) acrylate, cyclohexyl (meta) acrylate, etc.; as an example of alkoxy alkyl (meta) acrylate Methoxy ethyl (meta) acrylate, ethoxy ethyl (meta) acrylate, etc. can be mentioned. these are independent -- it is -- it can be combined and used For the acrylic adhesive property component from which using the acrylic ester which especially has the alkyl group of carbon numbers 1-8 by this invention (meta) constitutes the desirable adhesive component of this invention, the repeat unit guided from the above-mentioned alkyl (meta) acrylate (meta) (acrylic-acid alkyl ester) is usually preferably copolymerized in 78 - 97.5% of the weight of the amount 60 to 99.9% of the weight.

[0016] Moreover, as an example of the functional group introduced into the functional-group content monomer, a carboxyl group, a hydroxyl group, an amide group, a methylol machine, and an epoxy group can be mentioned. As an example of the functional-group content monomer into which the above functional groups were introduced An acrylic acid, beta-carboxy ethyl acrylate, an itaconic acid, (Meta) The monomer containing carboxyl groups, such as a crotonic acid, a maleic acid, a maleic anhydride, and maleic-acid butyl 2-hydroxyethyl (meta) acrylate, 2-hydroxypropyl (meta) acrylate, The monomer containing hydroxyl groups, such as chloro-2-hydroxypropyl (meta) acrylate, diethylene-glycol monochrome (meta) acrylate, and allyl alcohol Aminomethyl (meta) acrylate, dimethylaminoethyl (meta) acrylate, The monomer containing amide groups, such as a vinylpyridine, an acrylamide (meta), N-methyl (meta) acrylamide, and N-ethyl (meta) acrylamide The monomer containing epoxy groups, such as glycidyl (meta) acrylate, etc. can be mentioned to the monomer row containing an amide group and methylol machines, such as N-methylol (meta) acrylamide and a dimethylol (meta) acrylamide. these are independent -- it is -- it can be combined and used In the copolymer which constitutes the adhesive component of this invention, the repeat unit guided from the above-mentioned functional-group content monomer usually copolymerizes in 2 - 10% of the weight of the amount preferably zero to 20% of the weight.

[0017] Furthermore, a styrene system monomer and a vinyl system monomer can be mentioned as other monomers which form an adhesive component by this invention besides the above-mentioned monomer. concrete -- as the example of a styrene system monomer -- halogenation styrene [, such as alkyl styrene; FURORO styrene, such as styrene, a methyl styrene, dimethyl styrene, trimethyl styrene, ethyl styrene, diethyl styrene, triethyl styrene, propyl styrene, butyl styrene, hexyl styrene, heptyl styrene, and octyl styrene, chloro styrene, a bromostyrene, dibromo styrene and iodine styrene,]; -- nitro styrene, acetyl styrene, methoxy styrene, etc. can be mentioned further

[0018] Moreover, as an example of a vinyl system monomer, halogenation vinylidenes [, such as a halogenation vinyl; vinylidene chloride,], such as a conjugated-diene monomer; vinyl chloride, vinyl bromide, etc., such as a vinylpyridine, a vinyl pyrrolidone, vinylcarbazole, vinyl acetate, phenyl maleimide and an acrylonitrile; butadiene, an isoprene, and a chloroprene, etc. can be mentioned.

[0019] these monomers are independent -- it is -- it can be combined and used Copolymerization of the monomer besides the above can usually be preferably carried out in 0 - 10% of the weight of an amount zero to 20% of the weight into the

copolymer which constitutes the adhesives of this invention.

[0020] After supplying the above monomers to a reaction solvent for example, and replacing the air in the system of reaction by inert gas, such as nitrogen gas, heating stirring of the acrylic copolymer which constitutes the adhesives component of this invention can be carried out under existence of a reaction initiator as occasion demands, and it can be manufactured by carrying out polymerization reaction.

[0021] As a reaction solvent used here, an organic solvent is used and, specifically, ketones, such as fatty alcohol, such as ester, such as aliphatic hydrocarbon, such as aromatic hydrocarbons, such as toluene and a xylene, and n-hexane, ethyl acetate, and butyl acetate, n-propyl alcohol, and iso-propyl alcohol, a methyl ethyl ketone, a methyl isobutyl ketone, and a cyclohexanone, can be mentioned.

[0022] Moreover, when using a reaction initiator, an azobisisobutyronitril, benzoyl peroxide, G tert-butyl peroxide, a cumene hydroperoxide, etc. can be used.

[0023] The reaction temperature of the above-mentioned polymerization reaction is 50-90 degrees C, and reaction time is usually 4 - 12 hours preferably for 2 to 20 hours. Moreover, a reaction solvent is used in the amount of the 50 - 300 weight section to the total quantity 100 weight section of a monomer. Furthermore, a reaction initiator is usually used in the amount of 0.01 - 10 weight section.

[0024] the weight average molecular weight in the polystyrene reduced property by GPC analysis of the acrylic adhesion component obtained as mentioned above -- usually -- 100,000-2 million -- it is within the limits of 300,000-1,500,000 preferably

[0025] Moreover, 50 - 500poise / acrylic adhesives solution whose 25 degrees C are 50 - 200poise / within the limits of 25 degrees C preferably is usually preferably obtained for the viscosity of a solution [in / 25 degrees C / in nonvolatile matter concentration] 20 to 30% of the weight 20 to 40% of the weight by carrying out a polymerization in a solution as mentioned above.

[0026] Although it can also be used in this invention, being able to generate as occasion demands, still more newly being able to add other solvents, and being able to dissolve or distribute acrylic adhesives after removing some [at least] solvents from such an acrylic adhesive property component solution, it is desirable to use the organic-solvent solution of the acrylic adhesives obtained by carrying out copolymerization of the above raw material monomers as it is.

[0027] The acrylic adhesive property component obtained as mentioned above is thermoplasticity, is ordinary temperature, and has adhesion nature. The adhesives component which shows the insulation used by this invention contains the reactant component which has the above acrylic adhesive property components and at least two acryloyl (meta) machines, and the polymerization initiator.

[0028] The number of the repeats of the unit structure (polymerization degree) is about two to 20 polymer, the general concept of the oligomer and the prepolymer which are used by this invention is not enough as polymerization degree, and a high molecular compound is a polymerization object of the one step (high molecular compound) this side of polymer which has not become.

[0029] As a reactant component which has at least two acryloyl (meta) machines here, the oligomer or the prepolymer which has the polyfunctional monomer which has two or more acryloyl (meta) machines, and two or more acryloyl (meta) machines can be mentioned.

[0030] As an example of the polyfunctional monomer which has two or more acryloyl (meta) machines here, ethylene GURIKORUJI (meta) acrylate, neopentyl glycol diacrylate, 1, 6-hexane JIORUJI (meta) acrylate, trimethylolpropane triacrylate, a pentaerythritol thoria chestnut rate, etc. can be mentioned.

[0031] Moreover, as an example of the oligomer which has two or more acryloyl (meta) machines, and a prepolymer, polyethylene GURIKORUJI (meta) acrylate, pentaerythritol TORIAKURI roil hexamethylene di-isocyanate, bisphenol A-diepoxy (meta) acrylate, etc. can be mentioned.

[0032] these are independent -- it is -- it can be combined and used In connection with the polymerization initiator contained in the adhesives component in this invention being activated like the usual radical polymerization reaction by the reactant component which has such (meta) at least two acryloyl machines, the initiator radical which the activated initiator clove and generated induces cleavage and chain reaction of an ethylene nature unsaturation component, and a reactant component forms the macromolecule-ized network structure or macromolecule IPN structure.

[0033] the reactant component which has at least two above (meta) acryloyl machines -- the acrylic adhesive property component 100 weight section -- receiving -- usually -- the 1 - 100 weight section -- desirable -- 5 - 50 weight section -- it is especially used in the amount of 10 - 40 weight section preferably The adhesive component of this invention is activated by the polymerization initiator mentioned later, the macromolecule network structure or macromolecule IPN structure is formed, and the adhesive component of this invention is hardened and stops showing thermoplasticity with formation of such the structure of cross linkage by blending the reactant component which has at least two acryloyl (meta) machines in the above amount. Furthermore, when the reactant component which has at least two acryloyl (meta) machines in the above amount is blended, before hardening, the reactant component which has these (meta) at least two acryloyl machines acts as a plasticizer, and this adhesive component comes to have a good fluidity.

[0034] In this invention, the polymerization initiator contains further for the adhesive component. A thermal polymerization initiator and/or a photopolymerization initiator can be used as a polymerization initiator by this invention.

[0035] As a thermal polymerization initiator used by this invention, organic peroxide, an inorganic peroxide, an azo system thermal polymerization initiator, etc. can be mentioned. As an example of the thermal polymerization initiator of an organic

peroxide system, benzoyl peroxide, lauroyl peroxide, octanoyl peroxide and 3 and 5, and 5-trimethylhexanoyl peroxide can be mentioned here.

[0036] Moreover, potassium persulfate and an ammonium persulfate can be mentioned as an example of the thermal polymerization initiator of an inorganic-peroxide system. Furthermore, as an example of an azo system thermal polymerization initiator, azobisisobutyronitril, 2, and 2'-azobis-2-methyl butyronitrile and 4, and 4-azobis-4-SHIANOBARERIKKUASHIDDO can be mentioned.

[0037] the above thermal polymerization initiators are independent -- it is -- short-time hardening can be enabled by selecting suitably with the heating temperature at the time of being able to combine and use it and joining

[0038] Moreover, in this invention, a photopolymerization initiator can also be used with the thermal polymerization initiator instead of the above thermal polymerization initiators. In this invention, a carbonyl compound, a sulfur compound, and an azo system compound can be used as a photopolymerization initiator.

[0039] As an example of a photopolymerization initiator, an acetophenone, a benzophenone, a benzyl benzoin, the benzoin ether, azo-isobutyro-dinitrile, benzoyl peroxide, and JITASHARU butyl peroxide can be mentioned here.

[0040] The property of plasticizing if it heats after the macromolecule network structure or macromolecule IPN structure by the reactant component which has at least two acryloyl (meta) machines mentioned above in the adhesive component by blending such a polymerization initiator is formed and such structure is formed disappears.

[0041] the reactant component 100 weight section in which the above polymerization initiators have at least two acryloyl (meta) machines -- receiving -- usually -- 0.1 - 10 weight section -- it is preferably blended in the amount of 1 - 7 weight section Since the macromolecule network structure or macromolecule IPN structure is formed of the reactant component which has at least two above-mentioned acryloyl (meta) machines by blending a polymerization initiator in the above amount and a hardening object is formed of it, it is lost that this adhesion component shows a fluidity after adhesion. Therefore, even if the substrate pasted up using the different direction electroconductive glue of this invention is the case where it is used under a high-humidity/temperature condition, the bond strength and electrical property of this substrate stop being able to change easily.

[0042] Furthermore, the cross linking agent may contain for the above-mentioned adhesive component. This cross linking agent is the compound which unlike the reactant component which has at least two above-mentioned acryloyl (meta) machines can form the structure of cross linkage even if a polymerization initiator does not exist.

[0043] as the example of such a cross linking agent -- N, N, N', and N' - tetraglycidyl ether meta-xylene diamine and tolylene diisocyanate trimethylol-propane, hexamethylene di-isocyanate, and screw iso phthaloyl-1- (2-methyl aziridine) and tetramethylolmethane-tree beta-aziridinyl propionate can be mentioned

[0044] such a cross linking agent -- the acrylic adhesive property component 100 weight section -- receiving -- usually -- 0 - 10 weight section -- it is preferably blended in the amount of 0 - 1 weight section Furthermore, it is desirable to blend quinones or a polymerization inhibitor like a nitroaromatic into the adhesive component used by this invention, in order to suppress the polymerization reaction by the reaction of the above-mentioned polymerization initiator for example, at the time of preservation and conveyance etc.

[0045] Hydroquinone and methyl-ether hydroquinone can be mentioned as an example of a polymerization inhibitor here. thus -- the case where a polymerization inhibitor is used -- a polymerization inhibitor -- the polymerization initiator 100 weight section -- receiving -- usually -- 0.01 - 50 weight section -- desirable -- 1 - 50 weight section -- it is especially blended in the amount of 5 - 30 weight section preferably While the time of preservation and a transfer etc. can suppress advance of the polymerization reaction under the situation of not planning, by blending a polymerization inhibitor in the above amount, the reactivity of the reactant component which has at least two acryloyl (meta) machines at the time of heating sticking by pressure or optical irradiation sticking by pressure is not spoiled.

[0046] Furthermore, it is desirable to blend various coupling agents like a silane coupling agent with the adhesive component which has the insulation used by this invention. this coupling agent -- the acrylic adhesive property component 100 weight section -- receiving -- usually -- 0.5 - 3 weight section -- it is preferably blended in the amount of 1 - 2 weight section

[0047] The metal content particle is distributed in the adhesive component which the different direction electroconductive glue of this invention becomes from the above components. A metal layer is formed in the front face of the pre-insulation metal particles by which the front face of metal particles and metal particles was covered with the insulating component, the metallic-coating particle by which the metal layer was formed in the front face of an insulating core material, and an insulating core material, and there is a pre-insulation particle by which this metal layer was further covered with the insulating component among the metal content particles used by this invention.

[0048] As metal particles used here, a pewter, Zn, aluminum, Sb, U, Cd, Ga, calcium, Au, Ag, Co, Sn, Se, Fe, Cu, Th, Pb, nickel, Pd, Be, Mg, Mn, etc. are used. Even if it uses these metals independently, they may use two or more sorts, and they may add other elements, a compound, etc. further for reforming, such as a degree of hardness and surface tension.

[0049] Moreover, pre-insulation metal particles are particles by which the front face of the above metal particles was covered with the pressurization in the case of adhesion (it heats further) of the insulating component for which a metal-particles front face can be exposed. Such an insulating layer can be formed by the resin, the wax, or non-subtlety fine particles. It is desirable especially to form by this invention by non-subtlety fine particles, such as resins, such as a fluororesin, acrylic resin (meta), styrene resin, a cull navarho, polypropylene, or polyethylene, or a silica.

[0050] A metallic-coating particle is a particle by which the conductive metal layer was formed in the front face of an insulating core material. As an insulating core material, specifically here Polyethylene, polypropylene, Polystyrene, a methyl

methacrylate-styrene copolymer, an acrylonitrile styrene copolymer, Acrylonitrile-butadiene-styrene copolymer, a polycarbonate, Various acrylate, such as a polymethylmethacrylate, and a polyvinyl butyral, A polyvinyl formal, a polyimide, a polyamide, polyester, a polyvinyl chloride, A polyvinylidene chloride, a fluororesin, a polyphenylene oxide, a polyphenylene ape fight, The poly methyl pentene, a urea-resin, melamine resin, a benzoguanamine resin, A phenol-formalin resin, phenol resin, a xylene resin, a furan resin, a diallyl phthalate resin, an epoxy resin, the poly isocyanate resin, a phenoxy resin, silicone resin, etc. can be mentioned. A polystyrene, polymethylmethacrylate, and methyl methacrylate-styrene copolymer, phenol resin, and silicone resin are [among these] especially desirable. These resins can also be used independently, and two or more sorts can also be mixed and used for them. Furthermore, you may be denaturalizing these resins suitably. Moreover, by adding and making additives, such as a cross linking agent and a curing agent, react if needed, the structure of cross linkage may be formed and you may be a hardening object further.

[0051] Although a core material is manufactured by making such a resin material granular conventionally using a well-known method, it is desirable that the particle size is uniform. Specifically as the manufacture method of such a core material, an emulsion-polymerization method, a soap free emulsion-polymerization method, a seed emulsion-polymerization method, a suspension-polymerization method, a non-water dispersion polymerization method, a distributed polymerization method, interfacial polymerization, an in-situ polymerization method, hardening-among liquid coating, liquid drying, a dissolution distribution cooling method, the spray-drying method, etc. can be illustrated.

[0052] The metal layer which consists of metals, such as a pewter, and Zn, aluminum, Sb, U, Cd, Ga, calcium, Au, Ag, Co, Sn, Se, Fe, Cu, Th, Pb, nickel, Pd, Be, Mg, Mn, is formed in the above core material front faces.

[0053] As a method of forming a metal layer on the surface of a core material using such a metal For example, a vacuum deposition, the sputtering method, the ion plating method, plating, The chemical method to which the core material front face which the physical methods, such as a spraying process, can be used, and also consists of a resin which has a functional group is made to carry out the chemical bond of the metal through a coupling agent etc. if needed, In case the method of making a metal sticking to a core material front face using a surfactant etc., and the resin which is the material of a core material are compounded, a metal powder can be distributed in a monomer, and the method of making a metal powder sticking to the front face of the core material 7 made of a resin after a polymerization etc. can be mentioned.

[0054] Thus, as for the formed metal layer, it is desirable to be attached so that deformation of a core material may be followed and a particle may be transformed, when heating pressurization is carried out. Furthermore, this metal layer does not need to be a monolayer and the laminating of two or more layers may be carried out.

[0055] A pre-insulation particle is a particle which covered further with the insulating component the front face of a particle where the metal layer was formed in the core material front face as mentioned above so that a metal layer front face might be exposed with the pressurization in the case of adhesion (it heats further). Such an insulating layer can be formed by the resin or the wax, non-subtlety fine particles, etc. like the above. It is desirable especially to form by this invention by non-subtlety fine particles, such as resins, such as a fluororesin, acrylic resin, styrene resin, a cull navarho, polypropylene, or polyethylene, and a silica.

[0056] Such an insulating layer can be formed using well-known methods, such as a method immersed into the solution containing the resin which forms an insulating layer for a metallic-coating particle. It is desirable to form this insulating layer by the dry blending method which mixes the insulating component of the shape of a particle of especially the above to a metallic-coating particle, without minding a liquid, and forms an insulating layer in this invention by applying compressive force, shearing force, impulse force, etc. further if needed.

[0057] The particle diameter of the metal content particle used by this invention is made smaller than the interval of the circuit pattern which carries out different direction electric conduction adhesion. Usually, as for the particle diameter of this metal content particle, usual has preferably 1-50 micrometers of 2-20 micrometers of 2-10-micrometer mean particle diameters still more preferably.

[0058] Moreover, in the case of a metallic-coating particle, usual has still more preferably 0.05-5 micrometers of 0.01-10.0 micrometers of average thickness of a metal layer within the limits of 0.2-2 micrometers preferably. Moreover, as for the metal layer, the ratio of the diameter of metal layer thickness / core material usually has $1/100 - 1/5$, and thickness it is preferably thin within the limits of $1/50 - 1/10$.

[0059] furthermore, the average thickness of the insulating layer in a pre-insulation particle -- usually -- 0.01-5 micrometers -- desirable -- 0.1-2 micrometers -- further -- desirable -- within the limits of 0.2-1 micrometer -- it is -- the mean particle diameter of a core material -- receiving -- usually -- $1/50 - 1/5$ -- it has the thickness of $1/20 - 1/10$ preferably

[0060] the width of face of the top of the circuit pattern by which a conductive particle is arranged among the circuit patterns in which the mean particle diameter of the metal content particle furthermore used by this invention usually tends to carry out different direction conductivity adhesion -- it has $1/3$ or less mean particle diameter preferably $1/2$ or less The top's of a circuit pattern means the width of face of the upper-limit section of the circuit pattern currently formed by being close on the substrate, and calls the width of face of the circuit pattern section of a substrate and the stuck portion bottom width of face here. In the circuit pattern to which conductive adhesion is carried out, the direction of the upper-limit section of a circuit pattern, i.e., top width of face, is narrower than bottom width of face on the process which forms this circuit pattern. That is, when the mean particle diameter of a conductive particle is larger than one half of the top width of face of a circuit pattern, a conductive particle falls between circuits from on a circuit, and good conductivity may not be obtained, and when a conductive particle is still larger, it may short-circuit between circuits. Moreover, when the mean particle diameter of a conductive particle is smaller than $1/10$ of the top width of face of a circuit pattern, the contact of a conductive particle and a

circuit pattern becomes small, and good conductivity is not obtained.

[0061] the adhesive component 100 weight section in which the above metal content particles have insulation in the different direction electroconductive glue of this invention -- receiving -- usually -- 1 - 50 weight section -- it is preferably blended in the amount of 5 - 20 weight section While good conductivity is securable between substrates by blending a metal content particle in such an amount, there is also no fall of the bond strength between the substrates accompanying having blended the metal content particle.

[0062] Although the different direction electroconductive glue of this invention consists of an adhesion component which has insulation as mentioned above, and a metal content particle distributed in this adhesion component and has the outstanding property, it can suppress a flow of the resin in the constituent at the time of adhesion (adhesion component) by blending with this different direction electroconductive glue the non-subtlety particle which has a further specific particle diameter.

[0063] That is, a non-subtlety particle can be further blended with the different direction electroconductive glue of this invention. As a non-subtlety particle which can be used here, a mean particle diameter usually uses preferably 0.01-5.0 micrometers of 0.02-1.0-micrometer inorganic insulating fine particles. Furthermore, in this non-subtlety particle, usual [of a metal content particle] has the mean particle diameter of $1/10 - 1/100$ preferably $1/2$ or less. Moreover, it is usable, even if a particle diameter is the thing of a simple distribution and it is the thing of a double distribution as such a non-subtlety particle.

[0064] As a concrete example of such a non-subtlety particle, a titanium oxide fine-particles particle, a silicon-dioxide fine-particles particle, a calcium-carbonate fine-particles particle, a calcium phosphate fine-particles particle, an aluminum-oxide fine-particles particle, an antimony-trioxide fine-particles particle, etc. can be mentioned. Such a non-subtlety particle is independent, or can be combined and used.

[0065] the adhesive component 100 weight section to which the above non-subtlety particles have insulation in the constituent of this invention -- receiving -- usually -- the 1.0 - 50.0 weight section -- it is preferably blended in the amount of the 3.0 - 25.0 weight section within the limits

[0066] In the different direction electroconductive glue of this invention, especially a flow state can use the rate of a compounding ratio of an adhesives component and a non-subtlety particle as the constituent adjusted suitably by carrying out within the limits of 100:1-10:1 by the weight ratio.

[0067] Thus, by blending a non-subtlety particle, the fluidity of the different direction electroconductive glue of this invention in the case of heating pressurization adhesion can be adjusted. And a flow of the adhesives at the time of an elevated temperature and movement of the electric conduction filler accompanying it, and defective continuity are lost by blending the above non-subtlety particles.

[0068] Although the different direction electroconductive glue of this invention contains the non-subtlety particle blended by the adhesives component, the metal content particle, and the need of having insulation as mentioned above, other components may be further blended within limits which do not spoil the property of the different direction electroconductive glue of this invention.

[0069] For example, curing agents, such as thermosetting resin, such as phenol resin, a urea resin, melamine resin, and a benzoguanamine resin, a silane coupling agent like an epoxy silane system coupling agent, an isocyanate system curing agent, an epoxy system curing agent, a metal chelate agent system curing agent, and a melamine system curing agent, a weathering stabilizer, a heat-resistant stabilizer, a color, a pigment, etc. can be blended with the adhesive component which has insulation.

[0070] Furthermore, in an adhesives component, the so-called tackifier (tackifier) can also be added as an adhesion modifier. As an example of the tackifier which can be used here, a cumarone indene resin, an alkyl FANORU resin, a denaturation xylene resin, a terpene resin, rosin modified resin, etc. can be mentioned. the case where such a tackifier is used -- the acrylic adhesive property component 100 weight section -- receiving -- usually -- the 0.01 - 100 weight section -- it is 5 - 50 weight section preferably

[0071] The different direction electroconductive glues of this invention are forms, such as the shape for example, of a paste, are applied to the adhesion schedule side of a substrate, and although different direction electric conduction adhesion can be carried out by [which removed the solvent] irradiating electron rays, such as ultraviolet rays, being afterbaking-stuck by pressure or pressurizing, after they apply the different direction electroconductive glue of this invention on a releasing paper etc., a solvent is removed, and they can also use it for it, carrying out size enlargement to the shape of the shape of a tape For example, it can be used for the organic-solvent solution or dispersion liquid whose viscosity in 25 degrees C which dissolves or distributed the acrylic adhesive property component so that a nonvolatile matter might become 20 - 40% of the weight is 50 - 500poise / 25 degrees C as mentioned above in the form of the shape of the shape of a tape, and a sheet by distributing an above-mentioned metal content particle, preparing application liquid, and making it dry, after applying this application liquid to the base-material superiors which have detachability, carrying out.

[0072] For example, different direction conductivity adhesion which used the different direction electroconductive glue of this invention by which size enlargement was carried out to the shape of a tape is performed as follows. As shown in drawing 1, first, while was formed, and an electrode 2 lays the different direction electroconductive glue 4 of the shape of a tape which has a releasing paper 5 on the upper surface in the adhesion schedule section 3 of the edge of a substrate 1, presses down lightly for 2 - 9 seconds the temperature of 20-40 degrees C, and time, and carries out temporary adhesion of the tape-like different direction electroconductive glue 4 on a substrate. Subsequently, a releasing paper is removed, the upper shell of the different direction electroconductive glue 4 by which temporary adhesion was carried out, and another [in which the

electrode 12 was formed] substrate 6 are piled up, and alignment is performed. Subsequently, it pressurizes, while heating jointing by which alignment was carried out as mentioned above, and actual adhesion of a substrate 1 and the substrate 6 is carried out.

[0073] Rather than the case where 10 - 30 kg/cm² and heating pressurization time are 5 - 10 seconds, and the pressure which usually gives 120-160 degrees C of heating temperature in the case of this adhesion at the time of using the different direction electroconductive glue of this invention uses the conventional different direction electroconductive glue, heating temperature can be set up low and heating pressurization time is also shortened further.

[0074] Circuit patterns 2 and 12 are electrically connected by the metal content particle 10 between two substrates pasted up as mentioned above. Furthermore, by carrying out heating pressurization, flowing so that between a substrate 1 and 6 may be filled, in the stage in early stages of heating, the adhesives component which has a fluidity is hardened gradually and pastes up a substrate 1 and a substrate 6 mutually.

[0075] Moreover, when the different direction electroconductive glue of this invention contains a photopolymerization initiator, different direction electric conduction adhesion can be carried out by irradiating energy lines, such as ultraviolet rays, from a glass-substrate side instead of heating in the above-mentioned method.

[0076] By performing different direction conductivity adhesion as mentioned above using the different direction electroconductive glue of this invention, as shown in drawing 2, the metal content particle 13 is pinched between the circuit pattern 2 which confronts each other, and 12, and between a circuit pattern 2 and 12 is electrically connected by this metal content particle. On the other hand, the substrate portion in which circuit patterns 2 and 12 are not formed is firmly pasted up with the hardening object of the adhesion component which has insulation.

[0077] And that the different direction electroconductive glue of this invention heats the adhesive component which had the fluidity at the beginning, or by carrying out optical irradiation, this adhesive component hardens and a fluidity disappears. Therefore, even if it exposes the substrate pasted up using the different direction electroconductive glue of this invention to a severe condition for a long period of time, an adhesion property, electrical properties, etc., such as a bond strength, cannot be changed easily.

[0078] Moreover, different direction electric conduction adhesion can be performed good, without doing damage also to the circuit pattern to which fine pitch-ization is progressing quickly these days in the case of sticking by pressure, since it can paste up on conditions milder than the conventional different direction electroconductive glue. Furthermore, sticking-by-pressure time is short, and since heating temperature is also low, in case a flexible-printed-wiring substrate, a wiring substrate for liquid crystal devices, etc. in which the circuit pattern was formed are pasted up on a film-like substrate, it is rare [it] to do damage to these substrates.

[0079] In addition, when the particle which has an insulating layer is used for a front face as a metal content particle, with a pressure (it heats further), it is removed from a particle front face, a metal side is exposed, and good conductivity discovers the insulating layer of the metal content particle pinched by the circuit pattern.

[0080]

[Effect of the Invention] Since the different direction electroconductive glue of this invention contains the adhesives component which has insulation, the reactant component for which it becomes from the metal content particle distributed in this adhesive component, and this adhesives component has an acrylic adhesive property component and at least two acryloyl (meta) machines, and the polymerization initiator, moreover, different direction electric conduction adhesion of the substrate can be carried out on mild conditions in a short time. And although the different direction electroconductive glue of this invention has the fluidity before performing heating or optical irradiation, it forms a hardening object by heating or optical irradiation. Therefore, though the substrate pasted up by the different direction electroconductive glue of this invention is used in the place where temperature is high, or a humid place, the adhesive ability does not fall, therefore the electrical property between substrates is not changed.

[0081] Moreover, by using the different direction electroconductive glue of this invention, since the time which adhesion takes is based on the rapid hardening reaction by radical generating unlike the conventional different direction electroconductive glue, when ending for a short time and heating moreover, heating temperature can also be pasted up at low temperature rather than the case where the conventional different direction electroconductive glue is used. Therefore, while it decreases remarkably that electronic parts cause heat deterioration by heating in the case of adhesion etc., even when pasting up a heat-resistant low wiring substrate comparatively, for example like a flexible-printed-wiring substrate or the wiring substrate for liquid crystal, it is hard to generate exfoliation of a circuit pattern etc.

[0082] Furthermore, since the different direction electroconductive glue of this invention can form a hardening object by optical heating or irradiating within low temperature, low voltage, and a short time, Even if it pastes up the substrate in which the highly minute circuit (fine pitch pattern) to which it is going quickly in recent years was formed The poor circuit or poor conductivity accompanying the adhesives which have fixed the copper foil circuit to a polyimide or polyester film becoming soft, and a circuit shifting or receiving desorption and damage etc. does not occur.

[0083]

[Example] Although an example explains this invention below, this invention is not limited to these examples.

[0084]

[Example 1] The acrylic adhesives (A) of the composition shown below according to a conventional method were prepared. Ethyl acrylate 50 weight sections butyl acrylate 42 weight sections acrylic acid 3 weight sections acrylic-acid 2-hydroxyethyl It carried out by the 5 weight sections above-mentioned reaction's using toluene and an ethyl-acetate mixed solvent as a

reaction solvent, and using azobisisobutyronitrile as a polymerization initiator.

[0085] The nonvolatile matter of the toluene of the obtained acrylic adhesives (A) and the ethyl-acetate mixed solution was 30 % of the weight, and the viscosity in 25 degrees C of this solution was 180poise(s) / 25 degrees C. Moreover, the weight average molecular weight in the styrene reduced property by GPC of the obtained acrylic adhesives (A) was 500,000.

[0086] Independently, the nickel layer with a thickness of 0.2 micrometers was formed in the front face of the polystyrene particle of 10 micrometers of mean particle diameters, the gold layer with a thickness of 0.1 micrometers was further formed on it, and the conductive particle was prepared.

[0087] acrylic -- adhesives -- (-- A --) -- three -- organic functions -- a compound -- thermal polymerization -- an initiator -- a silica -- powder -- conductivity -- a particle -- N -- N -- N -- ' -- N -- ' - tetraglycidyl ether -- meta--- a xylene -- a diamine -- and -- a silane coupling agent -- the following amount -- blending -- a different direction conductivity constituent -- preparing -- this -- the thickness of 15 micrometers -- a releasing-paper top -- applying -- a different direction electroconductive-glue film -- having manufactured .

[0088]

Acrylic adhesives (A) 100 Weight section Trimethylolpropane triacrylate 10 Weight section BENSOI looper oxide 0.1 Weight section Silica powder 10 Weight section A conductive particle 15 The weight section N, N, N', and N' - tetraglycidyl ether meta-xylene diamine A 0.02 weight sections silane coupling agent 5 A sticking-by-pressure condition:sticking-by-pressure head (1.5mm width-of-face x50mm) is used using the different direction electroconductive-glue film which is the weight section above, and was made and manufactured. on the heating sticking-by-pressure conditions for 130 degree-Cx20 kgf/cm²x 10 seconds Heating sticking by pressure of TCP (top width of face of 25 micrometers of 70-micrometer pitch circuit and a copper foil circuit, bottom width of face of 30 micrometers, 40 micrometers of space sections, 300 pins) and the liquid crystal substrate (glass / ITO solid substrate, 8ohms / ** article) was carried out.

[0089] The flow resistance between 2 pins of the TCP circuit pasted up as mentioned above is measured, and it is shown in Table 1 by making a result into flow reliability. Moreover, table 1 Naka "-25.85 degree-C cycle" shows the resistance at the time of 500 cycle ***** based on the method specified to JIS-C -7021-1977.

[0090] Furthermore, it is shown in Table 1 by making into adhesion reliability the result which measured the bond strength according to JIS-Z -0237. In addition, in Table 1, "initial value" is a value 23 degrees C and after leaving it on condition that RH 65% for 2 hours, after carrying out heating sticking by pressure on condition that the above, "high-humidity/temperature examinations" is 80 degrees C and the value after leaving it in RH 90% for 500 hours, and "an elevated-temperature examination" is the value after leaving it at 100 degrees C for 500 hours.

[0091]

[The example 1 of comparison] In the example 1, the different direction electroconductive glue was similarly manufactured except having changed composition as follows.

[0092]

Acrylic adhesives (A) 100 Weight section Silica powder 10 Weight section A conductive particle 12 The weight section N, N, N', and N' - tetraglycidyl ether meta-xylene diamine The 0.02 weight sections A silane coupling agent 5 Adhesion reliability and flow reliability are shown in Table 1 about the different direction electroconductive glue of the weight section above.

[0093]

[The example 2 of comparison] In the example 1, the different direction electroconductive glue was similarly manufactured except having changed composition as follows.

[0094]

Acrylic adhesives (A) 100 epoxy resin Weight section () [the Ciba-Geigy Japan make,] [nonvolatile matter 100% 100 weight section epicure 3010(product made from oil-ized Shell Epoxy)] 2.5 Weight section Silica powder 35 Weight section A conductive particle 30 Weight section Silane coupling agent 5 Adhesion reliability and flow reliability are shown in Table 1 about the different direction electroconductive glue of the weight section above.

[0095]

[Example 2] Acrylic adhesives (A), 3 organic-functions compound, photopolymerization initiator, silica powder, conductive particle, 4, and 4-screw (diethylamino) benzophenone and the silane coupling agent were blended in the following amount, the different direction conductivity constituent was prepared, this was applied on the releasing paper by the thickness of 15 micrometers, and the different direction electroconductive-glue film was manufactured.

[0096]

Acrylic adhesives (A) 100 Weight section Trimethylolpropane triacrylate 10 Weight section Benzoin ethyl ether 0.5 Weight section 4 and 4-screw (diethylamino) benzophenone 0.2 Weight section Silica powder 10 Weight section A conductive particle 15 Weight section Silane coupling agent 5 The different direction electroconductive-glue film which is the weight section above, and was made and manufactured is used. Heating beforehand a sticking-by-pressure head (1.5mm width-of-face x50mm) at 90 degrees C, and sticking TCP (70-micrometer pitch circuit, 300 pins) and a liquid crystal substrate (glass / ITO solid substrate, 8ohms / ** article) by pressure by the pressure of 20 kgf/cm² From the glass-substrate side, the high-pressure mercury lamp was irradiated for 10 seconds.

[0097] The wavelength of this high-pressure mercury lamp was 3000-4000A, and irradiation gross energy was 1600 mW-sec/cm². The adhesion reliability and flow reliability between 2 pins of the TCP circuit pasted up as mentioned above are shown in Table 1.

[0098]
[Table 1]

表 1

	接着信頼性			導通信頼性（抵抗値）					
	接着力		耐定荷重試験 80℃, 11.25g/1.5mm	高温高湿試験		高温試験		-25℃・85℃+10%RH	
	初期	高温高湿		初期	500hr	初期	500hr	初期	500hr
	(gf/cm)	(gf/cm)		(Ω)	(Ω)	(Ω)	(Ω)	(Ω)	(Ω)
実施例 1	1200	1500	24hr後ハッチなし	1.8	2.5	1.8	2.2	1.8	2.2
比較例 1	950	1200	24hr以内に落下	2.0	1000以上	2.0	500以上	2.0	1000以上
比較例 2	100	1100	30分以内に落下	10	1000以上	10	1000以上	10	1000以上
実施例 2	1000	1400	24hr後ハッチなし	2.0	2.8	2.1	2.5	2.0	2.4

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing 1 is drawing showing typically the state at the time of pasting up a circuit pattern using the different direction electroconductive glue of this invention.

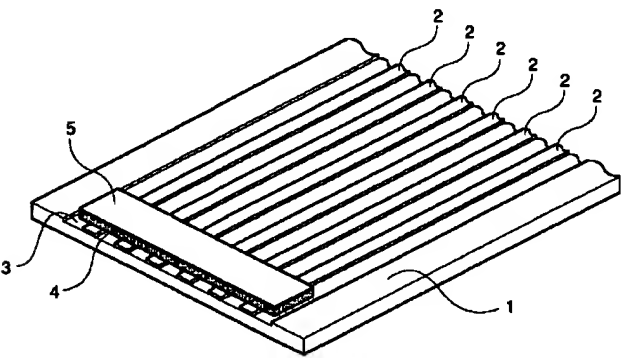
[Drawing 2] Drawing 2 is the cross section showing the state of the pasted-up circuit pattern typically.

[Description of Notations]

- 1 Six Substrate
 - 2 12 Circuit pattern
 - 3 Adhesion Schedule Side
 - 4 Different Direction Electroconductive-Glue Film
 - 5 Releasing Paper
-

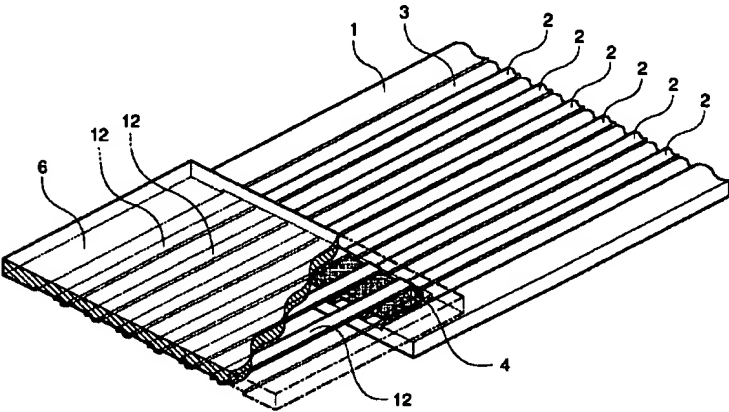
[Translation done.]

Drawing selection drawing 1 ▼



[Translation done.]

Drawing selection drawing 2 ▼



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